

H.S. John.

# Rhodora

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## CONTENTS:

Edward Blanchard Chamberlain. <i>C. H. Knowlton</i> .....	73
Pontederia versus Unisema. <i>M. L. Fernald</i> .....	76
Possibilities of Hybridism in Polygonum. <i>E. E. Stanford</i> .....	81
Another Arnica from Newfoundland. <i>M. L. Fernald</i> .....	90

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# Rhodora

JOURNAL OF

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EDWARD BLANCHARD CHAMBERLAIN.

CLARENCE H. KNOWLTON.

EDWARD BLANCHARD CHAMBERLAIN, son of Charles Edwin and Margaret J. (Blanchard) Chamberlain, was born in Bristol, Maine, July 24, 1878. Here his father was postmaster and proprietor of the village store. Both parents had been teachers, and he received most of his early education at home, where his attention was often turned to the interesting things of the natural world around them. He prepared for college at Lincoln Academy, Newcastle, Maine, where the principal, J. E. Dinsmore, was a stimulating amateur botanist.

Mr. Chamberlain entered Bowdoin College in the fall of 1895, following in the footsteps of his father, who was graduated there in 1868. He became a member of the Delta Kappa Epsilon fraternity. He was much influenced by Prof. Leslie A. Lee, an old-time all-around scientist, and took most of the scientific courses offered by the college. At graduation in 1899 he led his class, and became a member of Phi Beta Kappa. He then went to Brown University for two years as a graduate student and instructor in botany, receiving his degree of A. M. there in 1901. As his father had died during his college course, his mother went with him to Providence for these two years. Later she made her home among her own people at Cumberland Center, Maine.

The life work which Mr. Chamberlain entered upon was teaching in secondary schools. His first position, for one year only, was at Oak Grove Seminary, Vassalboro, Maine. He taught in the University School (for boys) in Washington, D. C., from 1902 to 1906; since then he has been a teacher in the Franklin School (for boys).

in New York City, where he taught till three days before his death. His teaching was mainly college preparatory science and mathematics, and he was very successful in it. He was also a strong man in the organization of the school, becoming senior master, "a most self-sacrificing and devoted member of its teaching staff," as one of his associates wrote of him. In recent years he has served as a reader in mathematics for the College Entrance Examination Board.

After the death of his parents Mr. Chamberlain made his summer home with his cousin, Mr. Henry H. Chamberlain, at Round Pond (Bristol), Maine. Here he lived a most lively existence, lending an active hand about the farm work, and building up his health and strength for the winter months in the city. He was most systematic in planning his life from day to day, and most conscientious in attention to details.

He was one of the original members of the Josselyn Botanical Society of Maine, and for many years he was an officer and an attendant at its meetings. To have known "Ed" on a field excursion was to have known him at his very best. Enthusiastic and a keen observer, he plunged into collecting with all the zest in the world, but he also seemed to feel a responsibility for the others in the party, and constantly went out of his way to assure himself that they were enjoying the trip, and getting their full share of its pleasures. He was most helpful with beginners, showing them what they needed to know, and helping them by word and letter. Withal he was a most cheerful individual on such occasions, mocking at the inconveniences of travel and hostelry, and keeping everyone interested by his characteristic comments.

Mr. Chamberlain became a non-resident member of the New England Botanical Club in 1898. He was a member of the Vermont Botanical Club, and of the Torrey Botanical Club, serving recently as a member of its Field Excursion Committee. When he lived in Washington he became a member of the Washington Biologists' Field Club, and of the Biological Society and Botanical Society there. He belonged to several other such societies, for his interest in science was broad. He was also an extensive reader along general scientific lines.

His herbarium of vascular plants was based mostly on the floras of Lincoln and Cumberland Counties in Maine, with some specimens from northern Rhode Island. His interest in this branch of botany

gradually gave way to an intense interest in the mosses, so that in 1921 he gave his carefully mounted specimens to the New England Botanical Club, where they form a valuable addition to the Club Herbarium.

At the Farmington meeting of the Josselyn Botanical Society of Maine in 1896, Mr. Chamberlain met Prof. J. Franklin Collins of Brown, and a year later at the Dover meeting Prof. Collins definitely interested him in the mosses. This friendship led to his graduate work at Brown, where as a part of his labors he identified a large portion of the mosses collected by Prof. Collins on Mt. Katahdin, which several members of the New England Botanical Club visited in 1900. The interest in mosses continued and grew steadily till he became an acknowledged authority on them. It had been Mr. Chamberlain's plan to give up teaching in a year or two, so as to devote himself entirely to scientific study, and he had thought seriously of doing so last fall. He had collected a remarkably fine and complete library of bryological lore, as well as a very large moss herbarium, and he was looking forward to years of study and classification.

For over ten years he has been the efficient Secretary-Treasurer of the Sullivant Moss Society, and Business Manager of their publication, *The Bryologist*. He corresponded with most of the members and subscribers here and abroad, and worked constantly and faithfully for its interests, often paying minor deficits from his own pocket. Such service as his can not be paid for, it comes from a desire to help others.

This spirit of helpfulness and service was the keynote of Mr. Chamberlain's character. Although he tried to keep himself in the background, it was his underlying motive in life. He was successful in helping others, too, in more ways than can be given here. Relatives, friends, students, and even casual acquaintances, all remember his characteristic ways of speech and writing, and the spirit that was in the man.

Mr. Chamberlain wrote several articles for *RHODORA* in its early days, and has been a frequent contributor to the pages of *The Bryologist*. As a letter-writer he was unexcelled, putting a great deal of himself into what he wrote, and gifted there, as elsewhere, with a strong sense of humor.

During the school year in New York he often took week-end trips in the open country with a small group of men to break the monotony

of teaching, and to reinvigorate him for indoor work. It was thus that he planned his last trip to Bear Mountain to view the total eclipse of the sun on January 24. The temperature was below zero, and he was thoroughly chilled, so that he had a bad cold when he returned. He taught the following week, but gave up on Friday night. Pneumonia developed, and he died quietly on the evening of February 2. He was the only child of his parents and never married, so he left no near relatives, except two aged aunts in the West.

By the terms of his will his library and collections are given to the New England Botanical Club where they will be of very great value to bryological students. His other property was left to Bowdoin College.

HINGHAM, MASSACHUSETTS.

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## PONTERDERIA VERSUS UNISEMA.

M. L. FERNALD.

IN recent years the American genus which has long passed as *Pontederia* L. has begun to appear in American botanical literature as *Unisema* Raf., and the common Pickerelweed of eastern America as *Unisema cordata* (L.) Farwell.<sup>1</sup> Since the proposition to relegate the name *Pontederia* to the Asiatic and Australian genus *Monochoria* Presl and to use for the American genus Rafinesque's name *Unisema* is not new and since there are valid arguments both for and against such a procedure it may be clarifying to look into the history of the Linnean genus *Pontederia*. As it appeared in the *Species Plantarum* (1753), *Pontederia*<sup>2</sup> had three species: (1) *P. ovata* of Malabar, which had been described and illustrated by Rhede, a plant with 1 stamen and consequently included by Linnaeus through error in his *Pontederia*, a genus which he placed in the class *Hexandria*; (2) *P. cordata*, the *Pontederia* of Linnaeus's *Hortus Cliffortianus* (1737), Gronovius's *Flora Virginica* (1739), etc., the Pickerelweed of eastern America, with dense spikes and with 1-seeded indehiscent fruits; and (3) *P. hastata* of India, the *Pontederia* of Linnaeus's *Flora Zeylanica* (1747) or the *Carim gola* of Rhede, a plant with umbels of flowers and with 3-valved many-seeded capsules.

<sup>1</sup> Farwell, Papers Mich. Acad. Sci. Arts and Lett. iii. 91 (1923).

<sup>2</sup> Sp. Pl. i. 288 (1753).

The description of the genus *Pontederia* in the 5th edition of the *Genera Plantarum* (1754) was a mixture based upon the 2nd and 3rd species of the *Species Plantarum*; but in general the name has been maintained by post-Linnean botanists for the American *Pontederia cordata*; Linnaeus's 1st species, *P. ovata*, clearly not belonging in the class *Hexandria*, being excluded as a member of the family *Marantaceae*, and the 3rd species, *P. hastata*, separated off as *Monochoria* Presl. Rafinesque<sup>1</sup> raised the point, that the generic description of Linnaeus called for "*Capsula* carnosae, conicae, apice late inflexae, trilobularis, triangularis, trisulca. SEM. subrotunda, plurima," which could apply only to his 3rd species, *P. hastata*, and that, therefore, *Monochoria* must be called *Pontederia* and *P. cordata*, with an indehiscent 1-seeded fruit, must belong to the new genus *Unisema* Raf. In thoroughly characteristic style Rafinesque scored Nuttall and others who maintained *Pontederia* for *P. cordata*: "All the servile American botanists, and even Torrey, who has verified the fruit, have followed this absurdity." Nevertheless not only practically all the "servile" American botanists since Rafinesque but such Europeans as Kunth, Bentham & Hooker, Solms-Laubach, Schönland, and even Otto Kuntze, have maintained *Pontederia* for the 1-seeded American group and have treated the many-seeded *P. hastata* as *Monochoria*. But since Farwell (l. c.) now revives *Unisema* for *P. cordata* it is evident that the reasoning which has appealed to the principal systematic botanists since Linnaeus needs statement.

That Linnaeus did not have a clear understanding of the floral structure of the plants he assembled under *Pontederia* is apparent from his three species: *P. ovata* with 1 stamen but put by Linnaeus into a hexandrous genus; *P. cordata* with six stamens and a 1-seeded indehiscent utricle; and *P. hastata* with six stamens and a many-seeded 3-valved capsule. Linnaeus's lack of understanding of the real floral structure of these plants is further exemplified by his editing of Loeffling's *Iter Hispanicum* (1758) in which he reduced Loeffling's manuscript genus *Phrygium*, with 3 stamens, without comment to his own supposedly hexandrous *Pontederia*. In other words, to say that Linnaeus, in the *Species Plantarum* and later, meant one of these plants rather than another as the "type" of *Pontederia* is futile; to him *Pontederia* was a group of superficially similar but structurally quite dissimilar plants and properly to understand what he originally

<sup>1</sup> Raf. Journ. de Phys. lxxxix. 261 (1819) and Med. Fl. ii. 105 (1830).

meant by the name it is necessary to trace *Pontederia* to its source. This, fortunately, is simpler than many nomenclatorial problems which lead back of 1753.

The name *Pontederia* seems to have started in 1737 when, in the 1st edition of the *Genera*, Linnaeus gave the same mixed description as in the 5th, the capsules 3-valved and many-seeded, but, stated that the plant was communicated by Gronovius (from Virginia). Simultaneously Linnaeus published *Pontederia* in *Hortus Cliffortianus* (1737), a plant with "floribus spicatis" which "*Crescit in aquaticis Marilandiae & Virginiae*" and identified with plates of the Virginian plant published by Petiver, Morison and Plukenet. Then, as a wholly secondary matter, he treated as probably congeneric with the Virginian species the Indian plant with 3-valved capsules and many seeds, saying: "*Hujus generis videtur Carim-golo Hort. mal. 11. p. 91. t. 44.*" And at this time, dealing primarily with the American plant, but associating with it as an apparently congeneric element the Indian species, Linnaeus gave the dedication of the name *Pontederia*:

"*Dixi hoc plantae genus a JULIO PONTERA, in Gymnasio Patavino Botanices Professore, Compendii Tabularum botanicarum, Dissertationum de floribus compositis & doctissimae Anthologiae auctore; ubi in examinando partes fructificationis paucos pares habuit.*"<sup>1</sup>

The confusion of the two plants, the Virginian with indehiscent 1-seeded fruits, the Indian with dehiscent many-seeded capsules, certainly entered into the original account of *Pontederia*; but at the time of dedicating the genus to Pontederia Linnaeus had chiefly in mind the plant of Maryland and Virginia. This fact is definitely established by his citations under the primary account, both in the *Genera* (1737) and in *Hortus Cliffortianus* (1737), of Morison, Gronovius, Petiver and Plunkenet, all of whom had the American Pickerelweed. This intent of Linnaeus is further made evident in the *Genera* ed. 5 (1754). There the mixed generic description of earlier editions is repeated and the only change is the insertion of the generic synonym "*Michelia* *Houst. A. A.*" This refers to the subsequently published *Michelia* *Houst. Rel. Houst.* (1781), a tropical American plant with 1-seeded fruits and clearly congeneric with *Pontederia cordata*.

In view of this historic evidence it is certain that there is good justification for maintaining *Pontederia* as Linnaeus originally intended it, for the American Pickerelweed,<sup>2</sup> even though Linnaeus

<sup>1</sup> L. Hort. Cliff. 133 (1737).

<sup>2</sup> Since this paper was prepared Mr. T. A. Sprague has reached the same conclusion, by the same course of reasoning. See *Journ. Bot.* lxii. 327 (1924).

himself confused the situation by merging with it members of three other genera (including another family) and describing the fruit of the Indian plant. As stated in Article 45 of the International Rules: "If the genus contains a section or some other division which, judging by its name or its species, is the type or the origin of the group, the name is reserved for that part of it." If, however, it is argued that from the start the generic description of *Pontederia* belonged as much to *P. hastata* as to *P. cordata* and that the two have equal claims to the generic name, it is important to note that ever since Linnaeus the overwhelming majority of botanists have treated the former as *Monochoria* and the latter as *Pontederia*. It is, therefore, incumbent upon those who desire plant nomenclature to remain generally intelligible to maintain this usage for, as clearly stated in the International Rules (Art. 5), "where the consequences of rules are doubtful, established custom becomes law."

The Pickerelweed of the northern United States and southern Canada, ranging southward to Virginia, Missouri and Kansas, more locally to northern Florida and Oklahoma, has very dense spikes, its blue-purple flowers white-villous especially before anthesis, its mature fruits 6–10 mm. long and its obovoid reddish seed 3.5–4.5 mm. long, 2–2.5 mm. in diameter. Its leaf-blades are comparatively soft, of very variable outline, the upper or cauline leaf with a slender petiole (above the sheath) averaging 4.5 cm. long.<sup>1</sup> This plant is *Pontederia cordata* L.

In tropical and subtropical eastern America the plant which passes as *Pontederia cordata* has firmer or harder foliage, the cauline leaves usually on shorter petioles (averaging 2.7 cm. long).<sup>2</sup> Its spike is looser-flowered than in the northern plant; its flowers are rather smaller and, instead of being white-villous, are glandular-dotted and sometimes hirtellous, in age often quite glabrate. Such mature fruits as have been available are 5–6 mm. long and the seeds 2.7–3.2 mm. long, 1.8–2 mm. in diameter. This plant has been examined from Paraguay, Brazil and Cuba and in the United States from Florida to Texas and northward to Virginia. Its narrow-leaved extreme was beautifully characterized by Nuttall as *P. lanceolata*<sup>3</sup> from Georgia and South

<sup>1</sup> Measurements of 60 specimens show a range of 1.5–12 cm. with an average of 4.5 cm.

<sup>2</sup> Measurements of 25 specimens show a general range from 0.5–3, very rarely to 14 cm., with an average of 2.7 cm.

<sup>3</sup> Nutt. Gen. i. 216 (1818).

Carolina, Nuttall specially emphasizing the "petiole very short," leaf "very opaque, in *P. cordata* the leaf is diaphanous when held to the light," and "unexpanded flowers and filaments of the stamina thickly covered with round, blackish, glandular atoms." The broader-leaved form of *P. lanceolata* has been characterized as *P. cordata*, forma *brasiliensis* Solms.<sup>1</sup>

The Pontederias of temperate North America may be distinguished by the following key:

- a. Spike dense: young and commonly the mature flowers white-villous; mature fruits 6-10 mm. long: seeds 3.5-4.5 mm. long, 2-2.5 mm. in diameter: leaves comparatively soft; the cauline with petioles averaging 4.5 cm. long *b*.
  - b* Leaves cordate at base.
    - Leaves narrowly deltoid-ovate, tapering with straight sides from base to apex.....*P. cordata*
    - Leaves broadly ovate, gradually curved from the broad base to the blunt summit.....*P. cordata*, forma *latifolia*
  - b* Leaves truncate to tapering at base, narrowly deltoid to linear-lanceolate.....*P. cordata*, forma *angustifolia*
- a. Spike rather loose: young flowers glandular and sometimes hirtellous, not villous, glandular or glabrate in age: mature fruits 5-6 mm. long: seeds 2.7-3.2 mm. long, 1.8-2 mm. in diameter: leaves comparatively hard; the cauline with petioles averaging 2.7 cm. long *c*.
  - c* Leaves lance-oblong to lance-linear, narrowed at base....*P. lanceolata*.
  - c* Leaves deltoid to ovate, truncate to cordate at base.
    - Leaves narrowly deltoid-ovate, tapering with straight sides from base to apex, truncate to shallowly cordate at base.....*P. lanceolata*, forma *trullifolia*.
    - Leaves ovate, gradually curving from the broad deeply cordate base to the summit.....*P. lanceolata*, forma *brasiliensis*

*P. CORDATA* L. Sp. Pl. i. 288 (1753). *Unisema cordata* (L.) Farwell, Pap. Mich. Acad. Sci. iii. 91 (1923).—Peaty, sandy or muddy shores, Nova Scotia to southern Ontario, south to northern Florida and Oklahoma.—Doubtless some of Rafinesque's proposed species of *Unisema* belong here but his descriptions are not detailed enough for definite identification.

Forma *LATIFOLIA* (Farwell) House, N. Y. St. Mus. Bull. No. 254: 207 (1924). *Unisema cordata*, forma *latifolia* Farwell, l.c. 92 (1923).—Usually in richer soils, and often wanting in the more silicious areas.

Forma *ANGUSTIFOLIA* (Pursh) Solms in DC. Monogr. iv. 532 (1883). *P. angustifolia* Pursh, Fl. Am. Sept. i. 224 (1814). Var. *angustifolia* (Pursh) Torr. Fl. N. and Mid. St. i. 343 (1824). *Unisema Purshiana* Raf. Med. Fl. ii. 107 (1830) and doubtless other spp.—Sandy or peaty shores, Prince Edward Island to Wisconsin, and southward east of the Appalachian system.

It is quite impossible from the meagre descriptions to say whether *P. lancifolia* Muhl. Cat. 34 (1813) and Ell. Sk. i. 382 (1817) belongs

<sup>1</sup> Solms in DC. Monogr. iv. 533 (1883).

here or with *P. lanceolata*. The description of the leaf applies to either, and neither Muhlenberg nor Elliott mentions the diagnostic characters. It is probable that *Unisema heterophylla* Raf. Med. Fl. ii. 108 (1830), "From New York to Louisiana" was based upon both this and the next.

*P. LANCEOLATA* Nutt. Gen. i. 216 (1818). *P. cordata*, var. *lanceolata* (Nutt.) Griseb. Cat. Pl. Cub. 252 (1866).—South Carolina to Texas and Paraguay. Since this species has been confused with *P. cordata*, forma *angustifolia*, it is desirable to cite characteristic specimens. GEORGIA: between Weycross and Ruskin, Ware Co., *Harper*, no. 1469. FLORIDA: Indian River, *Palmer*, no. 538; Duval Co., *Curtiss*, no. 2988,\* *Fredholm*, no. 5126; South Jacksonville, April 7, 1897, *Churchill*; Eustis, Lake Co., *Nash*, no. 450. TEXAS: *Lindheimer*, no. 194. CUBA: "introduced" in river, Taco Taco, Pinar del Rio, *Wright*, no. 3260; Coloma, Pinar del Rio, *Britton & Cowell*, no. 9693. BRAZIL: Matto Grosso, *Leeson*. PARAGUAY: in regione cursus superioris fluminis Apa, *Hassler*, no. 7849.

Forma **trullifolia**, n. f., forma typica recedit foliis anguste deltoideo-ovatis basi truncatis vel subcordatis.—VIRGINIA: Point Micon Reach, *Tidestrom*, no. 82. NORTH CAROLINA: Spencer, July 12, 1919. *P. O. Schallert*. FLORIDA: Okeechobee region, Brevard Co., August 3, 1903, *Fredholm*, no. 5927 (TYPE in Gray Herb.); Eustis, Lake Co., *Nash*, no. 449. TEXAS: San Patricio, *Lindheimer*, no. 2516; Houston, *Lindheimer*.

Forma **brasiliensis** (Solms), n. comb. *Unisema acutifolia* Raf. Med. Fl. ii. 107 (1830) based upon the characteristic figure in Lam. Encyc. t. 225 (1793). *P. cordata*, forma *brasiliensis* Solms in DC. Monogr. iv. 533 (1883).—The following are characteristic. FLORIDA: without definite locality, *Chapman* (Bilt. Herb. no. 752c); Duval Co., *Fredholm*, no. 5237; Port Orange, *Straub*, no. 134; Fort Myers, *Hitchcock*, no. 354, *J. P. Standley*, no. 104. LOUISIANA: Gretna, *Ball*, no. 329. PARAGUAY: central Paraguay, *Morong*, no. 490; near Lake Ypacuray, *Hassler*, no. 12,683; Sierra de Maracayú, *Hassler*, no. 5363.

GRAY HERBARIUM.

## POSSIBILITIES OF HYBRIDISM AS A CAUSE OF VARIATION IN POLYGONUM.

E. E. STANFORD.

DURING the last century a considerable number of hybrids within the subgenus *Persicaria* of the genus *Polygonum* have been reported in Europe. On the American side very little attention seems to have

been paid to the possibility of such crosses. From a comparison of Focke,<sup>1</sup> Figert,<sup>2</sup> Ascherson & Graebner,<sup>3</sup> and other sources, it appears that the first *Persicaria* hybrids to be announced as such were published as *Polygonum minori-Persicaria* and *P. dubio-Persicaria* by Alexander Braun<sup>4</sup> in 1824. What Ascherson & Graebner regard as the same plants have subsequently been frequently reported under various designations, and are now referred by them to *Polygonum Persicaria*  $\times$  *minus* and *P. Persicaria*  $\times$  *mite* (*P. dubium* having been reduced to *P. mite* Schrank). Since this early publication a considerable number of other *Persicaria* hybrids have been listed by various writers; the Ascherson & Graebner treatment, for example, enumerating the supposed results of such crossings under all the European species listed by them with the exception of *Polygonum amphibium* L. which appears, from examination of the literature, not to be considered to hybridize. This is not surprising, for *P. amphibium*, though extremely variable, is considered to have no close relatives in Europe, all the forms and varieties occurring there being generally considered to be below specific rank.

The criteria upon which reliance has been placed in the detection of hybrids have usually been demonstrable blending of the characters of the supposed parents, the presence of the latter in the vicinity, a greater or less degree of sterility, and often vigorous growth coupled with the production of unusually conspicuous flowers. The European *Persicarias*, with the exception of *Polygonum amphibium*, are annuals, and the hybrids, on account of their usual considerable sterility, have not usually been considered as becoming independently established or self-maintaining. The majority of these proposed hybrids, according to their bibliographies as given in the Ascherson & Graebner treatment, have mostly also been published by other authors as varieties or new species. The annual *Persicarias*, as shown in a previous paper<sup>5</sup>, are usually extremely productive of normal achenes, and the character of sterility has therefore been especially accentuated by most students who have described otherwise puzzling or "off-type" specimens as hybrids.

<sup>1</sup> Focke, Die Pflanzen-Mischlinge, 348, 349 (1881).

<sup>2</sup> Figert, Ueber Bastarde aus der Gattung *Polygonum*. Allgem. Bot. Zeitschr. 1. 26-30 (1895).

<sup>3</sup> Aschers. & Graebn. Syn. Mitteleur. Fl. iv. 800-875 (1913).

<sup>4</sup> A. Br. Fl. vii. 359, 360 (1824).

<sup>5</sup> Stanford, RHODORA, xxvii. 41-47 (1925).

Hy,<sup>1</sup> one of the few European authors to have published on floral dimorphism in *Persicaria*, was interested also in hybridism, and summed up his observations in part as follows:

"1. Dans les espèces annuelles de la section *Persicaria* les fleurs présentent un cas remarquable de dimorphisme par cleistogamie: sur la même inflorescence, les ûnes restent closes et fertiles, les autres s'ouvrent mais demeurent d'ordinaire stériles, faut de pouvoir se féconder elles-mêmes.

2. Dans les plantes normales les fleurs ouvertes et stériles sont toujours en moindre nombre même sur les espèces qui en présentent le plus comme *P. Persicaria* L. et *P. mite* Schr.

3. Dans quelques individus disseminés en petit nombre au milieu de leurs congénères, ces mêmes fleurs ouvertes et stériles existent seules ou à peu près, d'où il result stérilité complète ou presque complète pour la plante entière . . . dans . . . *P. Persicaria* × *P. mite* la proportion des fleurs fertiles était seulement de 1/150; dans . . . *P. Persicaria* × *P. minus*, 3 graines seulement se sont rencontrées sur 10 pieds . . . *P. minus* × *P. hydropiper*, n'a présenté aucune graine fertile. Ma conclusion était celle-ci: l'hybridité seule a pu causer cette stérilité."

Hy was also familiar with the type of heterostyly displayed by *Polygonum amphibium* L., which he considered of a type "absolument distinct . . . un exemple de plus à ceux . . . plantes physiologiquement dioques . . . sur les ûnes les styles sont courts, les étamines longuement saillantes et les fleurs demeurent stériles; sur les autres, les fleurs n'ont de saillant que le style mais produisent de beaux et bons fruits."

Of more recent writers Schuster<sup>2</sup> in his revision of *Polygonum lapathifolium* L. devoted considerable attention to hybridism as concerning his conception of this species and the numerous subdivisions which he made of it. He noted the occurrence of sterile pollen both in hybrids and in what he considered pure species, and stated:

"Allein der sterile Pollen bietet überhaupt kein sicheres Merkmal zur Erkennung von Polygonum-Bastarden, weil auch die Ähren der reinen Arten einen mehr oder weniger schlechten Pollen besitzen und unfruchtbar sind. Von den Polygonum-Bastarden wird in der Literatur allgemein behauptet, dass sie unfruchtbar sind; ich konnte indessen nicht einen Bastard finden, der vollkommen unfruchtbar gewesen wäre; allerdings ist die Fruchtbarkeit eine reduzierte indem in der Regel die Ähren eines Bastards mehr unfrucht-

<sup>1</sup> Hy, Troisième Note sur l'herborisation de la Faculté des Sciences d'Angers (1882); *Sur le dimorphisme floral dans quelques especes du genre "Polygonum."* Rev. de Bot. iv. 87-89 (1885).

<sup>2</sup> Schuster, Versuch einer natürlichen Systematik des *Polygonum lapathifolium* L. Mitteil. Bayerisch. Bot. Gesellsch. ii. 50-59 and 74-78 (1907).

bare Blüten zu enthalten pflegen als die reinen Arten . . . Samen von *P. mite* × *Persicaria* . . . die ich aussäte, keimten rasch und leicht. Natürlich können auch vollständig sterile Hybriden bei *Polygonum* vorkommen, jedenfalls aber ist dies nicht die Regel. . . ."

Schuster also noted that poorly nourished plants of *Polygonum Persicaria*, for instance, produced few fruits and by some botanists had therefore been taken for hybrids. He found pollen characters to be rather variable, and that hybrids often attracted attention by their unusual vigor. As to the pollen, further:

"Die sterilen Pollen, von denen ganz wie bei den reinen Arten bald ein grösserer bald ein geringerer Prozentsatz vorhanden ist, sind im allgemeinen nur halb so gross als die fertilen; bei *P. mite* × *Persicaria* mes en leitztere im Mittel 0,042 mm, die sterilen 0,021 mm."

He found variations in the pollen relief-markings of some hybrids which he believed to result from a blending of parental characters. He came to the conclusion that:

"*P. lapathifolium* nicht nur stark variiert, sondern auch sehr leicht bastardiert;" and enumerated 7 "Wirkliche Bastarde" and 3 "Vermeintliche Bastarde."

"Es ist im höchsten Grade wehrscheinlich, dass die sog. nichthybriden Übergangsformen der systematisch einander nahestehenden *Polygonum*-Arten nur Formen polymorpher Hybriden sind, die auch als hybridogene Arten auftreten können; wenigstens ist dies bei *P. mite* var *ambiguum* Thellung und *P. foliosum* Lindb. fil. der Fall."

These he had previously noted as forms of "dem polymorphen Bastard *P. Hydropiper* × *mite*." One emerges from the discussion with the feeling that what is really needed is the experimental production of a few hybrids in this subgenus, under controlled conditions, and a subsequent study of their behavior and characters. Owing perhaps to the small economic importance of these plants, and perhaps also to the inconveniently small size of the flowers, nothing of this sort appears to have been attempted.

Apparently the only American hybrid *Persicaria* thus far described as such in the American literature—at least in recent time—is *Polygonum hydropiperoides* × *robustius* Fernald.<sup>1</sup> Because of the bearing of this plant on the following discussion the original publication is quoted in full:

"*P. hydropiperoides* × *robustius*, n. hybr., caule decumbente basi valde lignescenti stoloniferoque plerumque 3-5 mm. crasso;

<sup>1</sup> Fernald, RHODORA, xxiv. 173, 174 (1922).

ramis floriferis adscendentibus 0.3–1 m. longis; foliis anguste ellipticis vel elliptico-lanceolatis acuminatis vel acutis 0.5–2 dm. longis 0.8–4 cm. latis; ocreis laxe cylindricis strigosis ciliatis, ciliis 2–5 mm. longis; pedunculis erectis elongatis; spicis filiformibus plerumque 0.4–1 dm. longis alternifloris, rhachi purpurascenti; ocreolis ciliatis; perianthiis lacteis 2–3 mm. longis, epunctatis vel rare punctatis; achaeniis vacuis.

NOVA SCOTIA: in great abundance in peat and granite gravel bordering outlet of Lamb's Lake, Annapolis Co., July 19, 1921 (foliage), *Fernald, Bartram, Long & Fassett*, no. 23,802, August 29, *Fernald & Long*, no. 23,803 (TYPE in Gray Herb.) and in *Pl. Exsicc. Gray*. September 16, *Donald McPherson*, no. 23,804.

Exactly combining the aspect and characters of the two species, both of which occur with or near it. In its coarse habit with stout subligneous base nearer *P. robustius*; in foliage intermediate; in the spike showing the slender habit of *P. hydropiperoides* and the purple color of the rhachis, but in the large milk-white flowers and the great length of the spikes suggesting *P. robustius*. Practically all the achenes are empty. Out of 135 sheets of specimens collected on August 29 we were able to secure only 5 partially filled achenes; while a mass of 100 or more older inflorescences collected in September by Mr. McPherson yielded no good achenes."

Both the parents of this plant are perennials, and, while seeding freely, also perennate by rhizomatiform stems. The hybrid colony, according to a personal statement to the writer by Professor Fernald, covered a space of many square rods, was spreading rapidly by stem-rooting, and might conceivably have arisen from a single seed.

Preliminary examination of the considerable amount of material ascribed by its various collectors to *Polygonum hydropiperoides* Michx., *P. amphibium* L., [*P. natans* (Michx.) Eaton] and *P. Muhlenbergii* Wats. [*P. coccineum* Muhl.] and accumulated in the Gray Herbarium indicated that here were three essentially well defined species whose representatives, while agreeing sufficiently with the normal type to be generally referred there, yet differed habitally and technically in a highly erratic manner. The material of *P. hydropiperoides*, a species more closely related to the bulk of the subgenus than the other two, often suggested a blending with other species. That of the amphibious species, which were apparently closely related, but not particularly akin to any other well recognized species in North America, often approached each other quite closely, particularly in aquatic phases. The opportunity of comparing conditions existing in this material with the better defined species of the group and that of the characteristic and well-defined hybrid above cited suggested that the latter might serve as well as an artificially produced hybrid for the establish-

ment of some idea as to whether the variations in these puzzling species might be due to the variability common in semi-aquatics, whether they represented more stable developments worthy to rank as varieties or possibly species, or whether the possibility of hybridism might also enter in.

The consideration of hybridism, naturally, was correlated with the study of flower-forms referred to more particularly in another paper,<sup>1</sup> in order to determine by what means such crossing might be brought about, as well as to consider the possibility of permanency of variations thus established. While the more showy species of *Persicaria* have well developed nectaries, and, to quote from a private communication from E. F. Phillips, Apiculturist, United States Department of Agriculture, "yield considerable quantities of nectar and are important honey plants,"<sup>2</sup> it is the writer's belief that close-fertilization is the rule and cross-fertilization the exception in the *Persicarias* of the northern and western states, with the exception of the amphibious group and possibly others of heterostyl habit in which the reverse is true. Granted a fertile close-fertilized hybrid, however, the chances of its survival would appear to be considerably greater than of one of a group in which cross-fertilization is the rule. Perennial *Persicarias*, of which *Polygonum natans*, *P. coccineum*, and *P. hydropiperoides* are evident examples, also occur in some number in America, in contrast to the condition in Europe, where *P. amphibium* is the only perennial. Their hybrids, like that cited above, would naturally tend to persist longer than those restricted to seed reproduction by annual habit.

In view of the recent interest in pollen conditions as a criterion of hybridism<sup>3</sup> the examination of the pollen of these plants at once

<sup>1</sup> Stanford, RHODORA, xxvii. 41-47 (1925).

<sup>2</sup> According to Pellett (Am. Honey Pl.), *P. Persicaria*, "heart's-ease," is the most generally important in this respect, though it varies greatly in value in different sections of the country. "This plant, so valuable in Illinois and Nebraska, is of no importance in Maine; a bee is rarely seen on the flowers." "The honey . . . varies greatly, both in quantity and quality. Some species do not seem to yield at all, at least not regularly, while others produce large quantities of nectar." This writer also counts the amphibious *Persicarias* as valuable honey-plants. Knuth (Handb. Fl. Poll.) from European studies, does not assign *P. Persicaria* or any other member of the genus especially high rank as a bee-plant. Jepson (Fl. Calif.) cites *P. acre* (*P. punctatum* Ell.) as an important honey-plant in California, although it seems not to be highly ranked elsewhere. Regional influence on honey-production seems much in need of study.

<sup>3</sup> The scope of the present paper does not permit a review of the extensive literature on pollen sterility, or a summary of the divergent opinion as to the value of defective pollen as a criterion of hybridism. Among the more recent American contributions

suggested itself. For this purpose the pollen of the staminate type of flower was used, as being much more abundant. For examination flowers on the verge of opening, but as yet unfolded, were chosen. After opening, both the pollen and the anthers soon disappear, and the flowers are often spoiled for the present purpose by the introduction of foreign pollen. The anthers were mounted in water, the pollen teased out and examined with various powers of the compound microscope. Water is not a proper mounting material for all types of pollen, but gives good results with that of *Persicaria* as obtained from dried herbarium material. Inasmuch as no germination tests could be carried out, no attempt was made to estimate exact percentages of imperfect pollen, although in most cases this could probably be done with a fair degree of accuracy. Variation between different specimens clearly referable to the same species is sufficient to render estimates based on examination of less than some scores of specimens more or less of an approximation.

The pollen of the subgenus *Persicaria* is spherical or nearly so, dark-pigmented, yellowish-brown under the microscope, and marked hexagonally more or less in relief. The diameter, in apparently average material, varies from 0.033–0.040 mm. in *Polygonum lapathifolium* to 0.060–0.066 mm. in *P. coccineum* (0.092 mm. in the more abnormal of the latter species). That of *P. hydropiperoides* averages 0.043–0.050 mm. in material showing virtually all apparently good pollen; this species is one of the more variable in the size, shape, and apparent quality of the anther-contents. The pollen of *P. robustius* is of approximately the same size; in this species it appears much more constantly normal, although the number of available specimens was not large.

In general it may be said that the report of Schuster that frequent variations exist in apparently good species was confirmed. The amount of variation differs widely in different species, and in different material, apparently typical, of the same species. In *Polygonum pensylvanicum*, for instance, as well as in *P. robustius*, the grains are usually very constant in size and only occasional plants show a variable proportion (10% or more) of defective individuals. That of

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to the subject mention might be made of the study of blackberries by Brainerd and Pierson, in which, as pointed out by Fernald (RHODORA, xxii. 185–191) a number of well recognized species are described as having from 70% to 85% of imperfect pollen, while others are listed as hybrids of such species, yet having as low as 10% imperfect pollen.

the essentially monotypic *P. virginianum* L. (subgenus *Tovara*) is extremely constant.

The flowers of *Polygonum hydropiperoides*  $\times$  *robustius* are of the open type, while the panicles of its parents usually contain both types. The pollen of the hybrid is produced in considerable quantity, though less abundantly than in the open flowers of the parent species, and is very variable in size and appearance. The grains range from 0.016–0.066 mm., the smaller evidently empty or distorted and nearly or quite unpigmented. Judging from the microscopic appearance in comparison with apparently normal pollen of other species, not over 5–10%, probably much less, could function. Correlated with this is a complete lack of development of the ovary, from which coordinate conditions in the egg may be deduced. A very similar type of defective pollen occurs frequently in specimens referred to *P. hydropiperoides*. Occasionally it is accompanied by wide-open evidently infertile flowers, in plants whose considerable variance from the type is often suggestive of mixed parentage with a more or less definite indication of the other species involved. More commonly it accompanies an apparently normal achene-production. Sometimes plants with apparently normal achenes and a large proportion of defective pollen appear inseparable from the type; more frequently, however, points of variance may be found. In this species the problem is complicated by the appearance of occasional plants apparently wholly of the pistillate type, with little or no pollen, and occasionally (more rarely) plants of the staminate type. It may be said that the appearance of considerable percentages of defective pollen in *P. hydropiperoides* is usually, but not invariably, connected with an "off-type." In the closely related *P. opelousanum* Riddell a variation was found which appears to be a blend of that plant with *P. punctatum* Ell. Specimens in most cases showed defective pollen, but the plant produced achenes in profusion.

Foreign hybrid material in the Gray Herbarium is exemplified by specimens referred to *Polygonum lapathifolium*  $\times$  *Persicaria*, *P. Hydropiper*  $\times$  *minus*, *P. Hydropiper*  $\times$  *mite*, *P. minus*  $\times$  *Persicaria*, and *P. mite*  $\times$  *Persicaria*. In general these specimens reveal a median character between their supposed parents and show pollen- and achene-characters comparable with some of the "off-types" discussed above.

In *Polygonum natans* and *P. coccineum* the segregation of flower-types somewhat complicates matters. In the long-styled flowers

pollen is usually absent. The ranges of the two species largely coincide except for a central area running southward and southwestward from Illinois, where *P. coccineum* runs southward into Mexico, apparently unaccompanied by *P. natans*. Where the ranges coincide the pollen of the short-styled flowers usually shows a large percentage of defective grains of a type quite comparable with that of the Nova Scotian hybrid above referred to. The long-styled panicles usually show a high degree of infertility and are often entirely barren. In the central belt mentioned, the pollen of the short-styled flowers of *P. coccineum* is usually normal, and the fertility of the other type appears to run higher, though still below what would be considered normal in another species.

Examination of all the short-styled specimens of *P. amphibium* L. in the Gray Herbarium (12 sheets) showed only one where the pollen was noticeably abnormal. In this European species, as in *P. coccineum* in the central North American belt referred to, the fertility of long-styled panicles is below what would be expected in another species, especially in the terrestrial form. Rather surprisingly, in the American *P. natans*, forma *Hartwrightii*<sup>1</sup> the pollen seems to be more nearly normal than in the aquatic form, although the latter is more frequently productive of achenes.

It appears probable that the cause of sterility in these perennials is in part bound up with the development of a vegetative mode of perennation and spreading, and not unlikely that in the American species the condition is further complicated by a considerable amount of cross-breeding; the result of these two factors, together with the variability common to aquatics, being visible in the highly variable series of plants so liberally christened by Greene.<sup>2</sup>

As a general conclusion it may be stated, that the evidence does not warrant changing the systematic rank of species or varieties which are known to be self-perpetuating and which have become more or less widespread over a definite range, but it does, in the present state of our knowledge, indicate the advisability of caution in the proposal of new species or varieties on the basis of variations seen in occasional herbarium sheets which show a considerable proportion of defective pollen and about the range and fertility of which little or nothing is known.

WESTERN RESERVE UNIVERSITY.

<sup>1</sup> *Polygonum natans*, forma *Hartwrightii* (Gray), comb. nov. *P. Hartwrightii* Gray, Proc. Am. Acad. viii. 294 (1870). To be discussed in succeeding paper.

<sup>2</sup> Greene, *Certain Polygonaceous Genera*. Leaf. i. 17-50 (1904).

## ANOTHER ARNICA FROM NEWFOUNDLAND.

M. L. FERNALD.

WHEN I published a study of the *Eastern American Representatives of Arnica alpina*<sup>1</sup> in 1924, in which seven species of this group were recognized from the Torngat Mts. of Labrador, the Long Range of Newfoundland and the mountains and cliffs of the Gaspé Peninsula, I was unaware that an eighth species had been collected by Messrs. Kenneth Mackenzie and Ludlow Griscom on Cape St. George, a western outlier of the Long Range. Mr. Griscom has most kindly placed in my hands for study a beautiful series of specimens, along with a perplexingly interesting collection of *Oxytropis*, *Potentilla* and other groups of arctic and cordilleran relationship, including the first *Carex concinna* R. Br. from Newfoundland and the first *Hedysarum Mackenzii* Richardson in eastern America.

The new Arnica grew on limestone barrens at Green Gardens, Cape St. George, where it was associated with *A. chionopappa* Fernald, *Kobresia simpliciuscula* (Wahlenb.) Mackenz., *Carex glacialis* Mackenz., *C. misandroides* Fernald, *Lesquerella arctica* (Wormsk.) Watson, *Dryas integrifolia* Vahl, var. *cancscens* Simmons, *Antennaria eucosma* Fernald, and other specialties of the neighboring Table Mt., Port à Port; and the collectors very naturally supposed they had merely found a new station for *Arnica pulchella* Fernald of Table Mt.

The plant of Green Gardens is, however, quite distinct from *A. pulchella*, being equally close to *A. alpina* Olin & Ladau of the Arctic, *A. Sornborgeri* Fernald of the Torngat Mts. and *A. attenuata* Greene of Alaska and Yukon. From each of these it is distinguished by several characters and it may appropriately be called

ARNICA **terrae-novae**, n. sp., rhizomate gracili horizontali; caule simplici vel furcato 1.7–3.4 dm. alto sparse piloso supra lanato; foliis rosulatis lineari-lanceolatis vel anguste oblanceolatis 0.5–1.4 dm. longis 0.5–1 cm. latis, 3–5-costatis integris sparse pilosis plus minusve glandulosis; foliis caulinis 4–5-jugis, inferioribus anguste oblanceolatis petiolatis integris sparse pilosis papilloso-glandulosisque, superioribus valde reductis apice callosis; pedunculis solitariis 5–13 cm. longis nudis vel bracteolatis, bracteolis linearibus apice subulatis; capitulis 4.5–7 cm. diametro; involucrio 1.3–1.5 cm. alto basi lanato; bracteis 13–20, rhomboideo-lanceolatis, exterioribus 2.7–4 mm. latis acuminatis laxe villosis; ligulis 9–13 luteis, lamina 1.6–2.5 cm. longa 5–8 mm. lata 9-nervata apice 3-dentata, dentibus acutis longioribus

<sup>1</sup> Fernald, RHODORA, xxvi. 103–107, t. 143 (1924).

3–8 mm. longis; corollis disci 8–9 mm. longis, tubo villosa 4–5 mm. longo; acheniis 5.5–6 mm. longis hirsutis; pappo maturo 7.5–8.5 mm. longo albo, setis barbellulatis.

Rhizome slender, horizontal: stem simple or forking from the base, 1.7–3.4 dm. high, sparingly pilose, lanate at summit: rosette-leaves linear-lanceolate or narrowly oblanceolate, 0.5–1.4 dm. long, 0.5–1 cm. broad, 3–5-ribbed, entire, sparingly pilose and more or less glandular: cauline leaves 4–5 pairs; the lower narrowly oblanceolate, petiolate, entire, sparingly pilose, papillose-glandular; the upper much reduced, callous at tip: peduncles solitary, 5–13 cm. long, naked or bracteolate; the bracteoles (when present) linear, subulate-tipped: heads 4.5–7 cm. broad: involucre 1.3–1.5 cm. high, lanate at base: bracts 13–20, rhombic-lanceolate; the outer 2.7–4 mm. wide, acuminate, loosely villous: ligules 9–13, yellow; the blade 1.6–2.5 cm. long, 5–8 mm. wide, 9-nerved, 3-toothed at apex; the teeth acute, the longer 3–8 mm. long: disk-corollas 8–9 mm. long; the villous tube 4–5 mm. long: achenes 5.5–6 mm. long, hirsute: mature pappus 7.5–8.5 mm. long, white; its bristles barbellulate.—NEWFOUNDLAND: limestone barrens, Green Gardens, Cape St. George, July 24, 1922, *Mackenzie & Griscom*, no. 11,039 (TYPE in Gray Herb.).

From *A. alpina*, *A. terrae-novae* is at once distinguished by its more abundant and pilose leaves, broader involucre bracts, longer and sharper teeth of the ligules, longer disk-corollas and longer achenes; *A. alpina* having only 1–3 pairs of nearly glabrous cauline leaves (in *A. terrae-novae* the 4–5 pairs pilose), the outer involucre bracts 2–3 (in *A. terrae-novae* 2.7–4) mm. wide, the blunt teeth of the ligule only 1–2 mm. long (in *A. terrae-novae* the teeth acute, the longer 3–8 mm. long), the disk-corollas 6–7 (in *A. terrae-novae* 8–9) mm. long and the achenes 3–5 (in *A. terrae-novae* 5.5–6) mm. long.

*A. pulchella* differs from *A. terrae-novae* in being densely villous (both stems and leaves), with callous-toothed basal leaves and only 1 or 2 pairs of cauline leaves and in having smaller heads with few (only 8–10) densely villous bracts.

*A. Sornborgeri* is distinguished from *A. terrae-novae* by its more glandular-viscid short indument, callous-toothed leaves (the cauline only 2 or 3 pairs), the uppermost leaves attenuate to a delicate usually curved appendage, the involucre of only 10–12 linear- or lance-attenuate bracts 1.2–1.5 mm. wide and the achenes only 3.7–4.7 mm. long.

The northwestern *A. attenuata* commonly branches above, with several (up to 12 at least) heads; has the foliage closely pilose-tomen-

tose, the involucral bracts linear- to lance-attenuate and the teeth of the ligules only 0.5-2 mm. long.

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